Safety and Health Hazards

- Chemical
  - Flammability/Combustibility
    - Upper Explosive Limit (UEL)/Lower Explosive Limit (LEL)
  - Reactivity
  - Irritants and Corrosives
  - Toxicity

Safety and Health Hazards

- Physical Hazards
  - Covered in “Work Practices”

Safety and Health Hazards

- Radiological
  - External Exposure
  - Internal Exposure

Safety and Health Hazards

- Biological Hazards
  - Pests and “other” wildlife
  - Medical waste and other biohazards

Chemical Hazards

- Flammability/Combustibility
  - Flammable - Flash Point < 100 Degrees F
  - Combustible- Flash Point above 100 Degrees F but below 200 Degrees F

Chemical Hazards

- Upper Explosive Limit (UEL)
  - Maximum concentration of a gas or vapor that will burn in air.
- Lower Explosive Limit (LEL)
  - Minimum concentration of a gas or vapor that will burn in air.

Chemical Hazards

Flammability/Combustibility –

Chemical Hazards

- Reactivity
  - Unstable chemical that can violently change
  - Reacts violently or explodes when mixed with water
  - Generate toxic gasses when exposed to low or high pH condition (Cyanides or Sulfides)
  - Explodes when exposed to heat or pressure
  - Any “recognized” explosive material

Chemical Hazards

- Reactivity – Hydrogen Peroxide in GWTPs

Chemical Hazards

- Corrosive Chemicals
  - Chemicals with a very low pH (acids)
  - Chemicals with a very high pH (bases)
  - Chemicals that when mixed with water produce very low or high pH solutions

  Acid or base reactions destroy tissue

Chemical Hazards

- Corrosive Chemicals – Lime (Calcium Hydroxide

  Need a picture of lime stabilization

Chemical Hazards

- Toxicity
  - Systemic Poisons
    - Acute
    - Chronic
  - Carcinogens

Chemical Hazards

- Toxicity – Systemic Poisons
  - Physiological Systems
    - Respiration
    - Nervous
    - Renal
    - Liver
    - Blood

Chemical Hazards

- Respiratory Toxins
  - Acute
    - Simple Asphyxiants
    - Carbon Monoxide
  - Chronic
    - Silica
    - Asbestos

Chemical Hazards

- Nervous System Toxins
  - Acute
    - Volatile Organic Chemicals
    - Organophosphate Pesticides and Nerve Agents
  - Chronic
    - Lead
    - Trichloroethylene

Chemical Hazards

- Liver Toxins
  - Acute
    - Carbon Tetrachloride
    - Chlorinated naphthalenes
  - Chronic (Cirrhosis & Fibrosis)
    - Trinitrotoluene(TNT)
    - Arsenical Pesticides

Chemical Hazards

- Renal Toxins
  - Acute
    - Heavy Metals
    - Toluene
  - Chronic
    - Lead
    - Cadmium

Chemical Hazards

- Carcinogens
  - Sometimes concentrated and “activated” in organs
  - Almost always affect DNA

Chemical Hazard

- Carcinogens
  - Benzidine – Bladder Cancer
  - Mustard Gas – Lung Cancer
  - Benzene – Leukemia
  - Vinyl Chloride – Liver

Chemical Hazards

- Estimating Toxicity
  - ACGIH TLVs
  - OSHA PELs
  - Substance Specific MSDS
  - NIOSH pocket guide

- Low Limit = High Toxicity or Carcinogen

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Exposure occurs by
    - Inhalation
    - Dermal Absorption
    - Ingestion

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Inhalation Hazards
    - Vapors – VOCs and Semivolatile Organic Compounds (vapor pressure< 10^{-4} mm Hg) in media and disturbed by the work.
    - Dusts – Semivolatile Organic Compounds (vapor pressure > 10^{-4} mm Hg), metals and other inorganic compounds in contaminated media.

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Dermal Absorption
    - Contaminated dust or “slop” settles on exposed skin
    - Fat soluble organics absorbed through the skin
  - Ingestion
    - Poor work practices allow contaminated dust or “slop” to get on hands and fingers.
    - Poor decontamination procedures
    - Too much hand to mouth contact

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Action Level (Al) – Vapors
    - Based on most toxic contaminant in the mix
    - Dependent on monitoring instrument
    - Dependent on selected respirator
    - Must specify a time limit and frequency
  - Low Al equates to fairly toxic contaminants with low PELs or TLVs.

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Action Levels – Dust
    - Based on the most toxic nonvolatile contaminant in the mix.
    - Dependent on monitoring instrument sensitivity.
    - Dependent on selected respirator
    - Must specify a time limit
  - Low Al equates to fairly toxic contaminants with low PELs or TLVs.

Chemical Hazards

- Toxicity Issues – Hazardous Waste Site
  - Dust Action Level Calculation

  Dust AL = E/C x 10^6

  E = Exposure Limit (mg/m3) PEL or TLV of the most toxic contaminant in the mix.

  C = Concentration (mg/kg) of the most toxic contaminant in the mix.

Chemical Hazards

- Toxicity Issues – Hazardous Waste Sites
  - Action Level Adjustment for Respirators

  Respirator AL = AL x PF

  Al = Action level without regard for the use of a respirator

  PF = Respirator Protection Factor

Radiological Hazards

- Sources
  - Radioactive isotopes in environmental media
  - Radium coated dials and gauges
  - Radium dust covered building surfaces
  - Pipe site disposal cleanup
  - Depleted uranium

Radiological Hazards

- Ionizing Radiation “Toxicity”
  - Disrupts cellular physiology to cause cell death
  - Affects DNA to promote the development of cancer.

Radiological Hazards

- Radiation Types
  - Gamma Radiation –penetrates all living tissue, not easily shielded
  - Beta Radiation – penetrates most living tissue, easily shielded with thin sheet of aluminum
  - Alpha Radiation – penetrates most living tissue, easily shielded with paper

Radiological Hazards

- Hazardous and Radioactive Waste Site Issues
  - Ionizing radiation sources (usually radioactive isotopes) not contained
  - Sources become part of normal construction dust

Radiological Hazards

- Hazardous and Radioactive Waste Site Issues
  - External Exposure –Exposure duration limited to duration of on-site work
    - Gamma Sources – Penetrate and deposit energy in all living tissue
    - Beta Sources – Penetrate and deposit energy in most living tissue
    - Alpha Sources – Shielded by the outer layer of dead skin

Radiological Hazards

- Hazardous and Radioactive Waste Site Issues
  - Internal Exposure – Continuously and repeatedly exposes internal living tissue for as long as radioactive isotopes are in the body.
  - Alpha, Beta and Gamma radiation deposited in internal living tissue – no alpha shielding.

Radiological Hazards

Biological Hazard

- Pests and other wildlife at hazardous waste sites
  - Ticks and mosquitoes – and the diseases they carry
  - Mice and rats – and the diseases they carry
  - Snakes, Alligators and spiders

Biological Hazards

- Medical Waste and “Other” Biohazards
  - Be wary (and account for) medical waste suspected to be in landfills
  - Be wary (and account for) biohazards when work requires cleaning up biohazard type wastes.

Biological Hazards

Biological Hazards

Biological Hazards